CLAIMS

What is claimed is:

1. A method for synchronizing a plurality of transmitters within a network, the method comprising the steps of:

placing each of the plurality of transmitters into a silent mode;

ranging selected transmitters of the plurality of transmitters; and

removing each of the plurality of transmitters from the silent mode and resuming normal operation.

2. The method of claim 1, wherein the network is a synchronous transmission network and the ranging step comprises the steps of:

requesting a particular transmitter of the selected transmitters to transmit a signal;

measuring the propagation delay associated with receiving the signal from the particular transmitter; and

adjusting the particular transmitter by the propagation delay for all future transmissions.

3. The method of claim 1, wherein the network is a TDMA based network and the ranging step comprises the steps of:

requesting a particular transmitter of the selected transmitters to transmit a signal at time t_0;

receiving the signal from the particular transmitter at time t_1; and

requesting the particular transmitter to transmit all further information at a time adjusted by the value of t_1-t_0.

4. A computer-readable medium having computer executable instructions for performing the steps recited in claim 1.

5. A computer-readable medium having computer executable instructions for performing the steps recited in claim 2.

6. A computer-readable medium having computer executable instructions for performing the steps recited in claim 3.

7. A controller operating within a communications network, the controller being communicatively coupleable to a plurality of transmitters through a communications path, the controller being operative to:

(a) detect that at least one of the transmitters of the plurality of transmitters is not transmitting at an appropriate time;

(b) disable particular transmitters of the plurality a transmitters from transmitting;

(c) select one of the detected transmitters as a selected transmitter;

(d) attempt a range operation on the selected transmitter; and

(e) if the range operation fails, enable each of the particular transmitters to resume transmitting.

8. The controller of claim 7, wherein if the controller's attempt at the range operation is successful and additional detected transmitters remain that the controller has not attempted the range operation on, the controller is further operative to:

(f) select another one of the detected transmitters as a next selected transmitter; and

(g) repeat steps d and e with the next selected transmitter.

9. The controller of claim 7, wherein if the controller's attempt at the range operation is successful and no additional detected transmitters remain, the controller is further operative to enable each of the particular transmitters to resume transmitting.

10. The controller of claim 7, wherein the controller communicates with each of the plurality of transmitters using a time-division-multiple-access protocol with each of the plurality of transmitters transmitting in an assigned time-slot and the controller is operative to attempt a range operation on the selected transmitter by:

requesting the selected transmitter to transmit a signal within a particular time slot starting at time t_0;

receiving the signal from the selected transmitter at time t_1;

measuring the propagation delay of selected transmitter by identifying the time between time t_0 and time t_1; and

sending a time adjustment to the selected transmitter based, at least in part, on the propagation delay.

11. The controller of claim 7, wherein the particular transmitters include all of the plurality of transmitters and if the controller's attempt at the range operation is successful and additional detected transmitters remain that the controller has not attempted the range operation on, the controller is further operative to:

(f) select another one of the detected transmitters as a next selected transmitter; and

(g) repeat steps d and e with the next selected transmitter.

12. The method of claim 7, wherein at least one portion of the communications path includes redundant communication sub-paths comprising a first sub-path and a second sub-path, the first sub-path and the second sub-path having different propagation delays for transmitted signals and only one of the first sub-path and the second sub-path are utilized at any particular time, and the controller is operative to detect when at least one of the transmitters is not transmitting at the appropriate time by:

requesting a particular transmitter of the plurality of transmitters to transmit a signal within a particular time slot starting at time t_0;

receiving the signal from the selected transmitter at time t_1; and

if the time t_1 differs from time t_0 by a threshold amount, identifying the particular transmitter as transmitting out of synchronization.

13. A diverse route TDMA communications network, the network including:

a controller;

a plurality of transmitters;

a communications path communicatively coupling the controller to each of the plurality of transmitters;

the controller being operative to:

assign each of the plurality of transmitters to a particular time-slot;

detect when at least one of the transmitters of the plurality of transmitters is not transmitting in the assigned time-slot;

enable wide-mode marshaling;

select a first transmitter of the detected transmitters;

attempt a range operation on the first transmitter;

if the range operation fails, disabling wide-mode marshaling; and

if the range operation is successful, selecting a next transmitter of the detected transmitters and continue at the attempt a range operation step with the next transmitter.

14. The network of claim 13, wherein the controller is operative to attempt a range operation on the first transmitter by being operative to:

request the first transmitter to transmit a signal within a particular time slot starting at time t_0;

receive the signal from the selected transmitter at time t_1;

measure the propagation delay of the selected transmitter by identifying the time between time t_0 and time t_1; and

send a time adjustment to the selected transmitter based, at least in part, on the propagation delay.

15. The network of claim 13, wherein the controller is operative to attempt a range operation on the first transmitter by being operative to request the first transmitter to transmit a signal within a particular time slot starting at time t_0 and wherein if the first transmitter does not respond, the range operation fails.

16. The network of claim 13, wherein at least one portion of the communications path includes redundant communication sub-paths comprising a first sub-path and a second sub-path, the first sub-path and the second sub-path having differing propagation delays for transmitted signals and only one of the first sub-path and the second sub-path are utilized at any particular time, and the controller is operative to detect when at least one of the transmitters is not transmitting in synchronization by being operative to:

request a particular transmitter of the plurality of transmitters to transmit a signal within a particular time slot starting at time t_0;

receive the signal from the selected transmitter at time t_1; and

if the time t_1 exceeds time t_0 by a threshold amount, identify the particular transmitter as transmitting out of synchronization.

17. The network of claim 13, wherein the controller is operative to enable wide-mode marshaling by being operative to disable each of the plurality of transmitters from transmitting.

18. The network of claim 13, wherein the TDMA network utilizes TDMA frames that include a header portion and a multi-channel portion, and the controller is operative to enable wide-mode marshaling by being operative to disable each of the plurality of transmitters from transmitting in the channels of the TDMA frame that are in close proximity to the header portion.

19. The network of claim 13, wherein the TDMA network utilizes TDMA frames that include a header portion and a multi-channel portion, and controller is operative to enable wide-mode marshaling by being operative to disable transmitters assigned to the channels of the TDMA frame that are in close proximity to the header portion from transmitting.

20. The network of claim 13, wherein the TDMA network utilizes TDMA frames that include a header portion and a multi-channel portion, and the controller is operative to enable wide-mode marshaling by being operative to disable a portion of the plurality of transmitters from transmitting, thereby allowing the remaining transmitters of the plurality of transmitters to only transmit in channels of the TDMA frame that are not in close proximity to the header portion.

21. The network of claim 13, wherein the TDMA network utilizes TDMA frames that include a header portion and a multi-channel portion, and the controller is operative to enable wide-mode marshaling by being operative to re-assign one or more of the plurality of transmitters to a different time-slot thereby allowing active transmitters of the plurality of transmitters to only transmit in channels of the TDMA frame that are not in close proximity to the header portion.

22. A method for ranging transmitters within a network, the network including a controller and a plurality of transmitters communicatively coupled to the controller over a communications path and exchanging information using TDMA technology, the method comprising the steps of:

assigning a particular transmitter of the plurality of transmitters to a particular time-slot of a TDMA frame to facilitate communication between the particular transmitter and the controller;

performing a search loop on a first set of transmitters of the plurality of transmitters wherein the operation of each of the first set of transmitters is verified;

identifying each of the first set of transmitters that fail during the search loop as a failed transmitter;

if the number of failed transmitters exceeds a first integrity threshold, disabling the transmission of a second set of the transmitters of the plurality of transmitters;

performing a range attempt on a first failed transmitter;

if the range attempt fails, enabling the transmission of the second set of transmitters; and

if the range attempt succeeds, performing a range attempt on a next failed transmitter until a range attempt has been performed on each failed transmitter or the range attempt fails, and then enable the transmission of the second set of transmitters.

23. The method of claim 22, wherein after the range attempt on a first failed transmitter fails and after enabling the transmission of the second set of transmitters, further comprising the steps of:

disabling the transmission of the second set of transmitters; and

performing a range attempt on a next failed transmitter if the number of failed transmitters exceeds a second integrity threshold.

24. The method of claim 21, wherein the number of failed transmitters exceeds a third integrity threshold, further comprising the step of performing a range attempt on each of the failed transmitters.

25. The method of claim 23, wherein the number of failed transmitters exceeds a third integrity threshold, further comprising the step of performing a range attempt on each of the failed transmitters.

26. A computer-readable medium having computer executable instructions for performing the steps recited in claim 24.

27. A computer-readable medium having computer executable instructions for performing the steps recited in claim 25.

28. A communications network including:

a controller;

a plurality of transmitters;

a communications path communicatively coupling the controller to each of the plurality of transmitters;

the controller being operative to:

assign each of the plurality of transmitters to a particular time-slot;

perform a search loop on a first set of transmitters, the search loop allowing the controller to identify a failed set of transmitters of the plurality of transmitters, the failed set of transmitters being transmitters that are not transmitting in synchronization;

if the number of transmitters in the failed set of transmitters exceeds a first integrity threshold , perform a first recovery process and, if the first recovery process aborts and the number of transmitters in the failed set of transmitters is greater than a second threshold, perform a second recovery process; and

if the number of transmitters in the failed set of transmitters exceeds a third integrity threshold, perform a third recovery process.

29. The communications network of claim 28, wherein the controller is operative to perform the first recovery process by:

(a) enabling wide-mode marshaling;

(b) selecting a ranging transmitter from the failed set of transmitters;

(c) performing a range attempt on the ranging transmitter;

(d) if the range attempt fails on the ranging transmitter, abort the current recovery process;

(e) if the range attempt succeeds on the ranging transmitter and additional transmitters remain in the failed set of transmitters, selecting a next transmitter from the failed set of transmitters as the ranging transmitter and continuing at step (c), otherwise, disabling wide-mode marshaling.

30. The communications network of claim 29, wherein the controller is operative to perform the second recovery process by:

(f) selecting a next transmitter from the failed set of transmitters as the ranging transmitter; and

(g) continuing at step (c).

31. The communications network of claim 29, wherein the controller is operative to perform the second recovery process by:

(f) selecting a next transmitter from the failed set of transmitters as the ranging transmitter;

(g) perform a range attempt on the ranging transmitter; and

(h) if the range attempt fails on the ranging transmitter and the number of transmitters remaining in the failed set of transmitters is greater than the second integrity threshold, continue processing at step (f), otherwise abort the second recovery process and disable wide-mode marshaling.

32. The communications network of claim 28, wherein the controller is operative to perform the third recovery process by:

(a) enabling wide-mode marshaling;

(b) performing a range attempt on each transmitter in the failed set of transmitters; and

(c) disable wide-mode marshaling.

33. The communications network of claim 28, wherein the first set of transmitters includes each of the plurality of transmitters.

34. The communications network of claim 29, wherein the controller is operative to enable wide-mode marshaling by requesting a second set of transmitters of the plurality of transmitters to stop transmitting.

35. The communications network of claim 34, wherein the second set of transmitters includes each of the plurality of transmitters.

36. The communications network of claim 29, wherein the controller is operative to enable wide-mode marshaling by restricting the transmissions of a second set of transmitters within a certain time-frame.

37. A controller communicatively coupleable to a plurality of transmitters via a plurality of communication paths within a TDMA based network, the controller being operative to:

perform a search loop to identify a failed set transmitters of the plurality of transmitters, the failed set of transmitters being transmitters that are not transmitting in synchronization;

if the number of transmitters in the failed set of transmitters exceeds a first integrity threshold, perform a first recovery process and, if the first recovery process aborts and the number of transmitters in the failed set of transmitters is greater than a second threshold, perform a second recovery process; and

if the number of transmitters in the failed set of transmitters exceeds a third integrity threshold, perform a third recovery process.

38. The controller of claim 37, wherein the controller is operative to perform the first recovery process by:

(a) enabling wide-mode marshaling;

(b) selecting a ranging transmitter from the failed set of transmitters;

(c) performing a range attempt on the ranging transmitter;

(d) if the range attempt fails on the ranging transmitter, abort the current recovery process;

(e) if the range attempt succeeds on the ranging transmitter and additional transmitters remain in the failed set of transmitters, selecting a next transmitter from the failed set of transmitters as the ranging transmitter and continuing at step (c), otherwise, disabling wide-mode marshaling.

39. The controller of claim 38, wherein the controller is operative to perform the second recovery process by:

(f) selecting a next transmitter from the failed set of transmitters as the ranging transmitter; and

(g) continuing at step (c).

40. The controller of claim 38, wherein the controller is operative to perform the second recovery process by:

(f) selecting a next transmitter from the failed set of transmitters as the ranging transmitter;

(g) perform a range attempt on the ranging transmitter; and

(h) if the range attempt fails on the ranging transmitter and the number of transmitters remaining in the failed set of transmitters is greater than the second integrity threshold, continue processing at step (f), otherwise abort the second recovery process and disable wide-mode marshaling.

41. The controller of claim 37, wherein the controller is operative to perform the third recovery process by:

(a) enabling wide-mode marshaling;

(b) performing a range attempt on each transmitter in the failed set of transmitters; and

(c) disable wide-mode marshaling.